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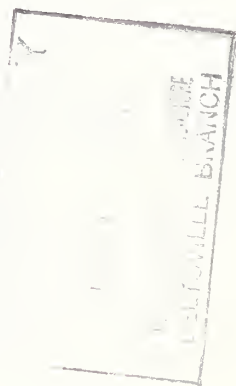
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REPORT
of
TWENTIETH NORTHEASTERN CORN IMPROVEMENT CONFERENCE

New York City
February 18-20, 1965

Reported by
G. F. Sprague, Secretary



Crops Research Division
Agricultural Research Service
United States Department of Agriculture
CR-22-65 March 1965

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REPORT OF THE TWENTIETH NORTHEASTERN CORN IMPROVEMENT CONFERENCE

New York City, N. Y.
February 19-20, 1965

MORNING SESSION, February 19

The meeting of the Northeastern Corn Improvement Conference was called to order by Chairman R. I. Brawn at 9:00 a. m. Following introductions the Chairman appointed a nominating committee consisting of D. L. Matthews, Chairman, M. W. Johnson and R. E. Anderson to select a candidate as Vice-chairman for 1966.

The Conference then received reports from the several standing committees. These reports are presented in the following sections.

REPORT OF THE COMMITTEE ON THE UNIFORM TESTS OF 100-300 MATURITY

A test of 23 experimental and 2 commercial hybrids as checks was planted in Pennsylvania, New York, Quebec (Macdonald College) and Ontario (Ottawa). Emergence of the Pennsylvania test was poor and it was subsequently abandoned because of the poor stand. Stands in the New York test were also spotty. In addition to the several plots with incomplete hills, there were also a number of missing plots. For this reason, it was decided to report only the Ottawa and the Macdonald College data, which are presented in Table 1.

Table 1. Performance of 25, 100-300 maturity series hybrids grown at Ottawa and Macdonald College, 1964

Entry No.	Pedigree	% Grain Moisture	% Erect Plants	Yield (Bus/Ac.15% Moisture)
1	(Col13xCol25)(Col09xA495)	29.4	96.6	108.6
2	(Col09xA509)(Q163xPA32)	31.7	98.2	118.7
3	(Col09xQ163)(Col25xPA32)	32.3	99.1	108.2
4	(Col13xPA32)(Col09xQ163)	35.1	99.0	104.9
5	(Col25xCol09)(Col150xQ163)	26.0	85.8	90.6
6	NE144	30.5	97.5	107.5
7	(Col09xA495)(Col25xA509)	27.3	98.9	110.0
8	(Q163xA495)(Col09xPA32)	34.8	96.7	106.6
9	(Q163xPA32)(Col09xA495)	35.4	96.8	110.5
10	(Col13xCol25)(Col09xQ163)	31.8	96.8	106.5
11	(Col13xA509)(Col09xPA32)	34.9	97.2	109.8
12	(A495xA509)(Col09xPA32)	31.8	97.2	112.7
13	(Col25xCol09)(Col158xA509)	26.5	95.7	105.8
14	(Col13xCol150)(Col09xQ163)	32.7	100.0	109.3
15	(Col150xCol09)(Col25xQ163)	26.1	95.2	110.3
16	(Col09xQ163)(Col25xA495)	31.7	92.9	109.3
17	Pride 5	33.1	97.5	109.2
18	Col25xA509)(Col09xQ163)	29.9	95.8	107.8
19	(Col13xA509)(Col09xQ163)	36.4	95.3	81.7
20	(Col13xQ163)(Col09xA509)	32.3	96.8	108.2
21	(Col158xA509)(Col09xPA32)	30.4	98.6	108.3
22	(Col13xQ163)(Col09xA495)	35.6	98.3	105.5
23	(Col09xQ163)(Col25xCol150)	30.9	95.4	104.1
24	(Col09xQ163)(Col150xA509)	30.9	94.2	112.7
25	(Col09xA495)(Col158xA509)	27.8	96.2	105.5
Means		- 31.4	96.4	106.9
Locations				
1-Ottawa		- 32.4	97.4	105.4
2-Mac.Col.		- 30.4	95.5	108.3
Hyb. LSD .05		- 1.4	3.4	7.3
Loc. LSD .05		- 0.4	1.0	2.1
CV		- 3.8	3.0	5.9

L. S. Donovan, Chairman
R. I. Brawn
W. F. Craig
H. L. Everett
W. I. Thomas

REPORT OF THE COMMITTEE ON THE UNIFORM TESTS OF 100-300 MATURITY

Double-cross hybrids which were made on the basis of predictions from 1962 data were grown by New York, Pennsylvania, and the Cooperative Corn Research Project. Table 1 shows the yield averages for these double-cross combinations. Since all the hybrids were not grown at each location, direct comparisons among all means in the overall average column should not be made.

Table 2. Yields in bushels per acre and average moisture percentage for the double-cross hybrids grown in 1964.

Cross	overall average		Yield Averages (bu/A)		
	yield	moisture %	New York	Penna.	CCRP
(Pa41 x W182D)(Pa409 x NY821)	89.7	26.8	80.0	59.1	130
(Pa41 x W182D)(ES55-157 x NY821)	73.0	26.5	73.5	72.5	--
(Pa409 x NY821)(NYD410 x W182D)	99.1	26.6	75.5	69.7	152
(NYD410 x W182D)(ES55-157 x Pa409)	89.1	24.5	66.7	69.7	131
(NYD410 x W182D)(Pa41 x Pa409)	93.7	24.0	--	54.4	133
(NYD410 x W182D)(Pa55 x NY821)	62.0	25.9	62.4	61.6	--
(ES55-157 x Pa409)(Pa41 x NY821)	91.7	25.4	85.7	86.5	103
(ES55-157 x Pa409)(W182D x NY821)	83.3	24.9	90.3	66.7	93
(NYD410 x Pa409)(Pa41 x NY821)	75.9	26.0	80.8	70.9	--
(NYD410 x Pa409)(W182D x NY821)	92.6	26.0	70.6	81.1	126
(Pa41 x NY821)(ES55-157 x PaB8B)	78.4	26.0	80.8	75.9	--
(Pa41 x NY821)(C153 x Pa409)	83.6	24.5	84.7	78.2	88
(W182D x NY821)(ES55-157 x PaB8B)	76.3	26.4	75.3	77.3	--
(W182D x NY821)(C153 x Pa409)	94.0	25.0	78.3	75.7	128
(ES55-157 x PaB8B)(C153 x Pa409)	74.5	24.8	78.0	70.9	--
(ES55-157 x PaB8B)(Pa55 x NY821)	71.3	25.8	76.4	66.2	--
(C153 x Pa409)(Pa55 x NY821)	97.3	23.5	94.9	80.0	117
(C153 x Pa409)(PaB8B x NY821)	76.0	24.8	80.6	71.3	--
(Pa55 x NY821)(Pa409 x W182D)	74.2	23.9	83.0	65.7	74
(Pa55 x NY821)(Pa41 x Pa409)	83.9	23.2	75.1	80.7	96
(Pa41 x Pa409)(W182D x NY821)	84.0	24.6	69.0	69.9	113
(Pa41 x Pa409)(PaB8B x NY821)	99.9	21.9	--	71.8	128

Seventeen double-cross hybrids were made by New York in 1964. These represent relatively early maturing hybrids in the 400-600 maturity range.

New inbreds were top-crossed to a single cross (Pa11 x Pa54) and to the double-cross, Michigan 250 (Oh51 x R53)(MSW10 x MS206) by New York, Pennsylvania and Cooperative Corn Research Project.

H. L. Everett, Chairman
C. E. Manchester
J. H. McGahan
M. L. Risius
H. Yegian

REPORT OF THE COMMITTEE ON THE UNIFORM TESTS OF 700-900 MATURITY

There were no cooperative tests in these maturity groups in 1964.

The cooperators have made up 3-way crosses involving a total of 25 selections on testers C103 x B14, C103 x Pa887P, and B37 x Oh43.

J. C. Anderson, Chairman
J. Buchert
R. G. Rothgeb
W. I. Thomas

REPORT OF THE COMMITTEE ON DISEASES AND PESTS

As indicated in our 1964 report, no regional studies were proposed. Each station was to continue their various individual efforts.

Replies to our letter requesting information on which to report indicated maize dwarf mosaic had replaced stalk rot as the major topic of interest. Dr. Sprague will be reporting on this matter this afternoon. Several suggestions were made regarding possible cooperative efforts in meeting this problem.

Drs. C. C. Wernham and R. H. Hamilton supplied the following information on stalk rot for this report.

1. Cyclic hydroxamate, often designated as corn sweet substance (CSS) yields 6 - METHOXYBENZOXAZOLINONE as a degradation product. It is easily detected and assayed by colorimetric methods in corn seedlings. Because of the interest in the degradation product as a factor responsible for disease resistance in cereals it was decided to test the association of CSS with stalk-rot resistance.

Twenty-two low assay stocks (2 late, 5 intermediate and 10 early)* and 25 high assay ones (5 late, 9 intermediate and 9 early) were planted self pollinated and inoculated August 17, 1963 by the pipecleaner method with Gibberella zeae. Results were taken in October on the basis of plants standing per entry. These numbers were converted to percentages and graphed.

* 5 low and 2 high assay lines were discarded due to poor stands.

In the low assay group, wide fluctuations in percentage standing plants were quite evident, although extremes in performance were not as marked as in the high assay group.

In the high assay group, the late ones were remarkably good, and the intermediates were almost as good with no greater deviation. The early entries however, fluctuated from 0% - 100% (82, 8k, 90, 22, 91, 36, 100, 0, 100).

Since these seed lots showed considerable variation in individual seedling assay, the test should be repeated with inbred lines of greater genetic purity and a longer record of stalk-rot performance.

2. Transfer of stalk rot resistance by backcrossing. Stalk rot is a difficult character to attain because there are so many non-genetic influences that affect its expression.

There are however a few inbred lines that are widely recognized as being stalk-rot resistant, that hold a hybrid up and a few high yielding but stalk weak lines notorious for their tendency at maturity to fall over in a gentle wind. Cl03, Pa 70 and Bl4 - rather late lines belong in the first class; Pa W703, W37A and Pa 54 are strong contenders for the second type.

In spite of the fact that stalk rot inheritance is considered to be strictly quantitative, the tendency of certain inbreds to hold up hybrids of which they contribute at best 25% of the inheritance leads one to believe that a certain amount of dominance of strong stalks is displayed in these combinations.

Crosses were made as follows:

(Bl4 x PaW703)PaW703: (Pa70 x PaW703)PaW703: (Cl03 x PaW703)PaW703*¹
(Bl4 x W37A)W37A : (Pa70 x W37A) W37A : (Cl03 x W37A) W37A*²
(Bl4 x Pa54)Pa54 : (Pa70 x Pa54)Pa54 : (Cl03 x Pa54) Pa54

*1 Only 3 plants available - all BC₁ and recurrent parental line used to make BC₂ seed.

*2 Cross delayed 1 year due to seed failure.

In 1963 the second backcrosses were made whenever possible to the BC₁ parent - otherwise to the recurrent parental line eg.*1. The BC₁ plants were selected according to duration of standing ability, the last harvest being December 2. Seed set per ear was also taken into evaluation.

In 1964, where possible 3 entries of plants harvested 12/2 were compared with 2 entries harvested mid-November and one entry harvested October (negative stalk strength). All plants were inoculated. These were compared against the selections from the recurrent parent.

The results indicate that duration of standing ability in 1963 was not necessarily the best criterion of standability in 1964. (This may have been due to fungal infection of grain on the ear, a factor which in 1964 almost ruined the C103 derivatives - especially crosses with W37A).

In 1964 harvest was made at times judged to be critical for each recurrent inbred. The best and poorest were again selected, care being taken to avoid too long contact with the earth of ears on lodged plants.

In every case the selfed BC₂ test row selected was as good or far superior to the parental recurrent inbred. The 1964 selections will be carried into 1965.

1963 harvest data for 1964 choices

Pedigree of BC ₂	Best	Poorest	1964 harvest date	Latest 1963 harvest
(B14 x Pa54) Pa54 ² /	12/2 12/2 10/0	11/15	12/7	12/2
(Pa70 x Pa54) Pa54 ² /	12/2	12/2	12/7	12/2
(C103 x Pa54) Pa54 ² /	12/2 11/22 11/9	10/0	12/7	12/2
(B14 x W37A) W37A ² /	12/2 11/9	11/15	11/26	12/2
(Pa70 x W37A) W37A ² /	11/22	12/2	11/26	12/2
(B14 x PaW703) PaW703 ² /	12/2	10/0	11/17	12/2
(Pa70 x PaW703) PaW703 ² /	11/1	11/15	11/10	11/15
(C103 x PaW703) PaW703 ² /	11/15 11/9	10/0	11/10	11/15
		(Cross on inbred line)		

M. W. Johnson, Chairman

J. C. Anderson

C. W. Boothroyd

R. H. Cole

J. L. Peterson

R. G. Rothgeb

C. C. Wernham

REPORT OF THE COMMITTEE ON CORN SILAGE RESEARCH

A tabulation of the corn silage research which was considered at the Nineteenth Northeastern Corn Improvement Conference is presented in Table 3. Some of this work was not undertaken and in many cases the data from the 1964 trials are not yet available. A progress report of the several types of studies undertaken follows.

300-400 Maturity

Testing station hybrids and CCRP experimentals at 19,000 plants per acre:

Location: Feeding Hills, Massachusetts and Bridport, Vermont
Drought conditions at both of these locations created variable yields.

Results: (in order of yield) Cornell M3 and C445; W335A, Pa.290 and Pa. 444 - all good performers.

400 Maturity Population Study

Population: 21, 25, and 29 thousand plants per acre.

Location: Feeding Hills, Massachusetts

Hybrid: C445, Cornell M3, Pa. 444

Results: Variable soil moisture due to drought. C445 best at 29M population and top yielder. M3 and Pa. 444 - no significant increase in dry matter yield from 21M to 29M.

500-600 Maturity

Station hybrids and CCRP experimentals

Location: Feeding Hills, Massachusetts

Results: Drought conditions, but fairly uniform soil moisture.
Best performers - E.S. 508, W. Va. 555, C505, J.J. 11 and Pa. 602A in that order.

700-900 Maturity

Station hybrids and CCRP experimentals.

Location: Palmyra, Pennsylvania

Results: Generally uniform soil conditions. Some variation in pollination due to timing of dry spell. Best performers - E. S. 800, NE 912, N.J. 9 in that order.

Table 3. Tabulation of corn silage research to be conducted in the Northeast - 1964 - as indicated at the Northeast Corn Improvement Conference, Feb. 21-22, 1964

Stations and Agencies Participating (* = probably, # = possible)

Activity	Conn.	Del.	Me.	Md.	Mass.	N.H.	N.J.	N.Y.	Pa.	R.I.	W.Va.	C.E.F.	Mac.	CCRP
I. Regional field trials														
Standard tests	*	#			#	#	*	*	*	#	*	*	*	*
Population studies							*	*	*					*
Fertility studies							*	*	*		#	*		*
Species comparisons					*		*	*	*					#
Weed control							*	*	*					#
II. Breeding														
Regional nurseries							*	*	*				*	*
New germ plasm							*	*	*				*	*
Method studies														
III. Quality evaluations														
Chemical tests									*		*			
Digestibility:								#						
Rumen			#											
Sheep								*	*	*	*	*		
Dairy animals								*	*	*	*	*		
Other								*	*	*	*	*		
IV. Extension and Commercial														
Testing														
Quality evaluation								*	*	*	*	*		
Cost analysis studies								*	*	*	*	*		
Agronomic trials								*	*	*	*	*		
Variety trials								*	*	*	*	*		
Storage & Handling								*	*	*	*	*		

DELAWARE

Silage yields (Tons/Acre at 65% moisture) were obtained for nineteen hybrids tested under 4 rates of fertilizer application. There were significant yield differences between hybrids and between fertilizer treatments. The highest fertilizer level averaged yields 2.5 tons/acre greater than the next lower treatment.

Other trials tested the effects of types of nitrogen, cultivation after herbicide treatment, and irrigation.

MacDonald College, QUEBEC

Conducted four variety trials of Canadian hybrids for adaptation to Quebec conditions. All entries were fertile grain corn hybrids.

MARYLAND

Began a four year project, conducted jointly by the Agronomy and Dairy Departments on a contract basis with the Dairy Cattle Research Branch, USDA, "The effects of variety, selection, and production methods of corn on the cost and feeding value of corn silage for dairy cattle."

The plan of work calls for a preliminary study on small plots of the effects of variety and cultural practices involving plant density, and differences in varieties relative to time required to reach maturity, time from silking to maturity, and dry matter distribution in plant parts at progressive stages of maturity.

Several variety-maturity-culture combinations will be ensiled from large plots each year to determine digestibility or energy and protein, and ad lib intake by dairy steers. A final evaluation will be based on a milk production trial.

In 1964 a crop was grown on both small plots and large plots. Numerous data were taken on both plot types, and 9 lots of silage from the large plots were ensiled and are now being fed. Data are now being analyzed for 12 hybrids grown on the small plots.

From year to year some substitution may be made in the preliminary trials. This may provide an opportunity to insert hybrids of particular interest to the NECIC.

MASSACHUSETTS

A silage trial was conducted testing five commercial hybrids ranging in maturity from early (Mich 250) to late (Funk G77A) in a factorial design with three dates of planting (May 6, 20, and June 1) and at three spacing distances between plants in rows (8, 10, 12 inches) three feet apart. The crop was harvested on September 15, 1964.

The effect of date of planting on the yield of green fodder was not significant. June 1 plantings produced as much fodder as the May 20 or 6th. This may be one of the reasons why many dairy farmers here plant corn later part of May or early in June because they know they can fill the silo just as fast with later planted crop as they would with early planting.

Date of planting, however, had profound effect on dry matter yield. The highest yield of dry matter was obtained from May 6 planting. Yield decreased with delayed planting. The moisture content of June 1 planting was 3 per cent higher than May 20 and 7 per cent higher than May 6 planting (79, 76, and 72 per cent moisture at harvest, respectively). The grain production was highest with the May 6 planting and decreased with delayed planting due to lack of sufficient growing days from silking to harvest. For our section it requires from 45 to 55 normal growing days from silking to dent stage. Varieties that begin to silk about July 20-25 would be considered full season hybrids here for silage corn with 70 per cent moisture at harvest in early part of September.

The 8 inch spacing produced about 4 tons more silage calculated at 70% moisture than 10 or 12 inch. Where moisture and soil fertility, plant food, are not the limiting factor, we find populations of 22 to 25 thousand will produce optimum silage.

The late variety produced about two tons more silage than the midseason variety but the moisture content was 2 per cent higher; therefore, the quality of the silage would not be as good as a crop which has 70% moisture at harvest.

NEW JERSEY

Standard evaluation studies for silage conducted in 1964. A continuing study on yield potential of barren vs normal stalks resulted, as in previous years, in a 15% loss in dry matter production on the barren NJ-9 vs the fertile counterpart.

NEW YORK

1. Silage evaluation trials were conducted at four locations of early and medium - early commercial and experimental hybrids, and at three locations for medium - late and late maturing hybrids. Yield per acre is reported for green weight, dry weight, grain component, and TDN. Percentages of total dry matter and of grain content were calculated.
2. A milk production study on cows fed "regular" corn silage and silage made from "high-sugar" corn was conducted with the Holstein dairy herd at the Agricultural Technical Institute, Canton, New York. The Departments of Plant Breeding and Animal Husbandry cooperated with ATI in gathering agronomic and animal yield data in 1963-64, and are repeating the study in 1964-65.

The results of the 1963 silage yields and the milk production study based on these lots of silage are summarized as follows:

- a. Regular corn silage produced more dry matter and total digestible nutrients per acre.
- b. HS 50 (without grain) yielded slightly more green weight per acre but moisture content was higher.
- c. Stalks without grain had a higher sugar content but this did not add to the feeding value of the silage.
- d. Animals consumed 5.6 pounds more HS 50 than Penn. 290, but the total silage intake of HS 50 had 5.2 pounds less dry matter.

The cows used in this test were in early lactation and producing well. All treatments maintained a normal pattern of lactation. Certainly, HS 50 was not superior to Penn. 290 and in view of the low dry matter intake over a complete lactation, it would appear that normal corn silage is still to be recommended.

3. Forage yield trials were conducted with a wide array of annual grasses, including sudangrass, sorghum, sudan-sorghum crosses, and corn. Tests were conducted at three locations under a two cutting and a single harvest regime. Maturity, height and weight of plants, leaf-stem ratio, and prussic acid content were scored, as well as total green weight and dry matter production. For full season production, with a single harvest, corn gave superior yields. This has been a consistent result over several years trials under widely varying climatic conditions.
4. Feeding trials with sheep and dairy animals are being conducted to check comparative digestibility and palatability values of representative varieties of the annual grasses. Materials are fed as chopped dry forage. Attention focuses on correlations between data from the two animal species, as well as comparisons among the forages.

5. Corn hybrid x population x methods of planting

Three hybrids (Penn. 290, Cornell M-3 and M-9) were planted at three populations (20, 35, and 50M) at two locations (Ithaca and Marcellus) in 1964. A 36-inch-row width was used for the 20 and 50M populations; three row widths were used for the 35M plantings: 36 inch, 18 inch, and a "twin-row" pattern with 6 inches between the two and a 30-inch interval separating the twin rows. Silage and grain yields were taken. The study will be continued in 1965.

6. A corn hybrid x population study was conducted in 1963 and 1964 at two locations. Hybrids include Penn. 290, Mich. 250, Cornell M-4, M-3, M-9, and Penn. 602A. Populations planted ranged from 16 to 32 thousand per acre; populations at harvest varied somewhat from these goals. Row width was 36 inches in all tests. Hybrids varied appreciably in their curves of response to population differentials. Because unusually early frosts occurred in both years, the study will be continued in 1965.

OTTAWA

No silage tests in 1964. Results of a three year feeding trial for milk production of silage from an early and a late hybrid are summarized on page 35 of the 1964 proceedings of the Canadian Society of Agronomists.

PENNSYLVANIA

Research conducted in 1964; no data analyzed as yet:

1. Extensive test of single-cross and double-cross hybrids predicted from single-cross data for dry matter production and high and low stalk sugar. Third year data in 1964 on the following: silking date, ear height, plant height, stalk diameter, ear leaf length, stalk sugar, total green weight, total dry weight, ear weights, stalk weights, moisture, protein, and spectrochemical analyses for 11 elements. A replicate test was grown for grain production.

The inbreds involved in the hybrid material were tested separately for the same measurement criteria.

2. Measurement of stalk sugars and sugar content of frozen plant material of entries including an open pollinated variety and each of four cycles of selection for both high and low stalk sugars.

3. Measurement of stalk sugar in a high and low inbred lines, their f_1 and f_2 , and 1st and 2nd backcrosses to both parents.

4. Third year data on 25-50-100 thousand plant populations of three hybrids, both F_1 and F_2 generations. Measurements were silking date, total green weight, dry matter, moisture percentage, fiber, protein, and spectrochemical analyses for 11 elements.

5. Comparison of HS-50 and Pa. 825, grown with and without grain formation permitted, at six populations (12, 16, 20, 24, 28, 32 M/A). Data as above, plus separate ear and stalk weights and stalk sugar.

6. Trials of early season, medium season, and late season Pennsylvania recommended commercial hybrids, plus experimental hybrids, for total green weight and dry weight. Plots were machine planted and harvested with a converted forage harvester.

7. A study was begun in 1964 to determine optimum plot size for yield evaluation of corn silage when harvested by machine. Five hundred 1/1000 acre plots were harvested from a uniformity trial, and all possible combinations will be evaluated in an attempt to find the plot size giving best estimates of yields per acre. Correlations of dry matter determinations from sub-samples and the plot proper will be made.

WEST VIRGINIA

Standard silage trials were conducted with yield data plus chemical tests and artificial rumen data. Material was grown for a digestion trial with sheep and lactating goats. Due to personnel changes this trial may not be completed.

A "HEAT UNIT" SYSTEM FOR CORN HYBRID RECOMMENDATIONS

D. M. Brown

Ontario Research Foundation
Toronto 5, Canada

In the northern fringe areas of production of grain corn there is a tendency to plant hybrids that are too late in maturing. The reason is the scarcity of high yielding hybrids adapted to these areas. In order that Ontario farmers might estimate their chances of successfully growing hybrids of various maturity classes, a system of rating hybrids based on temperatures has been devised. This system has been applied to weather data to subdivide the province into zones for corn hybrid recommendations.

For the past 22 years hybrid recommendations in Ontario have been made on the basis of a zonal map shown in figure 1. Hybrids have been recommended for early, medium and late situations in each zone. This leads to confusion when explaining that the late hybrids in a zone should be grown if a farmer plants his corn early, and early ones if he plants late. Another confusing point is the day classification used by some corn companies. It leads to confusion because: (1) a 100-day hybrid recommended by one company may be the same as a 105- or 110-day hybrid recommended by another; (2) it always takes a greater number of days from planting to maturity than that used to label a given hybrid; (3) the actual number of days varies considerably from year to year.

With the hope of improving corn recommendations in Ontario we set out to obtain some of the fundamental relationships between weather conditions and the development of corn. Phenological data were recorded on 4 hybrids grown at 5 locations in Ontario over a 5 year period. (Some results from these experiments were reported at the last Agricultural Meteorology Conference, in St. Louis.) As pointed out at that time any system used to classify corn hybrids had to be based on temperatures because most of the variation in days to tasselling, pollination and maturity could be explained by temperature differences among locations and years, illustrated in figure 2.

The use of temperatures is also dictated by the fact that temperature and precipitation are the only two meteorological factors observed on a daily basis with proper geographical density and for a long enough time for climatic classification.

The most common climatic index is the "heat unit" or "day-degree" system. It has been criticized often, but is very useful in climatic classifications. Heat indices are usually based on daily mean temperatures, because this represents the average temperature to which a plant or crop is exposed for any 24 hour period. However, use of this daily mean temperature masks the high maximums that are often above the optimum for crop growth. It was suggested by Dr. F. A. Brooks in his paper at this conference in 1958 that ".....it seems opportune to consider a subdivision of the mean daily temperature as an important factor in climate classification".

In the system set up for corn recommendations in Ontario, day and night temperatures are handled separately in arriving at a final heat sum. The relationship used was as follows:

$$\text{Daily Heat Units} = \left[(T_{\min} - 40) + (4.39 T_{\max} - .0256 T_{\max}^2 - 155.18) \right] / 2$$

Thus a threshold of 40°F. is assumed for night temperatures and a unit linear response per degree for growth above this temperature. The MAXIMUM temperature relationship is a parabola, derived from previous work on soybeans (Brown, 1960). It has a base at 50°F. and an optimum at 86°F. as shown in figure 3. Work reported by Went, 1957 showed that nighttime temperature requirements for most plants are lower than daytime requirements, therefore it seemed reasonable to assume that threshold temperatures would differ in a similar manner. The daily heat sums were divided by two simply to make them comparable to units based on daily mean temperatures.

This expression actually gives a family of curves, shown in figure 4, for various diurnal ranges of temperatures. It is obvious from these curves that at temperatures below 55°F. a wide daily range is an advantage while at high temperatures a narrow range produces more rapid crop development. This seems logical from a physiological standpoint because respiration is more dependent on temperature (heat energy) than is photosynthesis (depends on radiant energy), except at low temperatures where reduced CO₂ diffusion may limit photosynthesis. Therefore, a wide daily range at low mean temperatures (40-50°F.) means that daytime temperatures are high enough for photosynthesis to occur and some growth takes place because respiration is probably negligible; whereas a narrow daily range at low mean temperatures limits both photosynthesis and respiration, consequently no growth occurs. When the mean is above 65°F. temperatures are near the optimum for photosynthesis as long as CO₂ and light are adequate. Therefore on days with a wide range (20-25°F.) the respiration rate is lower with respect to the photosynthetic rate than on days with a narrow range at the same mean temperature. This results in a higher rate of dry matter accumulation with a wide range than with a narrow one, and a high rate of dry matter accumulation and growth rate slow up development or progress to maturity.

Good evidence was available for using these relationships from the data collected in our corn phenology studies from 1956-60. Using a method suggested by Robertson & Holmes, 1957, the reciprocal of days in the emergence to tasseling and in the silking to maturity periods was used to express the average rate of development per day in these periods. These reciprocals were multiplied by 1000, to bring the values to whole numbers, and then related to average mean temperatures in the period for each year and location. Regression lines were fitted to the data for each period-emergence to tasseling (figure 5) and silking to maturity (figure 6). These slopes were similar to the family of curves (figure 4), in the range of temperatures encountered in our field studies, that is 60-75°F.

Of course the proof of any scheme is in its application. Fortunately, the Ontario Corn Trials provided needed information from the check hybrids. When "heat units" were accumulated from planting to maturity (35% kernel moisture) for these hybrids grown at 4 locations for 5 years, the "heat sums" were considerably less variable than "number of days" in the period, as shown in Table 4. The coefficient of variation of "heat units" is only 2.6% and that for "days" is 7.2%. As a result of these findings it was decided to define the corn hybrids that are recommended for production in Ontario on the basis of these "heat units", using maturity data collected in the Ontario Corn Trials.

The final step in this programme was the application of this scheme to weather records and the re-division of the province into zones defined in terms of "heat units". The average planting date was taken as the date of occurrence of a mean temperature of 55°F. The end of the growing season was assumed to be the date before which there are no killing frosts in nine years out of ten. The "heat sums" based on monthly average maximum and minimum temperatures between these dates for each weather station were plotted on a map and isopleths at intervals of 200 were drawn to sub-divide the province, as shown in figure 3 of enclosure entitled "How to determine 'Heat Units'....."

It is hoped that this method of rating and recommending corn hybrids will assist farmers in selecting adapted hybrids especially in the fringe areas of production in Ontario. It might also be useful in climatically similar areas of Minnesota, Wisconsin, Michigan, Pennsylvania and New York.

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TABLE 4

HEAT UNITS* AND (DAYS) BETWEEN PLANTING AND PHYSIOLOGICAL MATURITY FOR P.A.G. 55 GROWN AT 4 TEST SITES FOR 5 YEARS

	<u>1958</u>	<u>1959</u>	<u>1960</u>	<u>1961</u>	<u>1962</u>
Malden	2984 (134)	3059 (116)	3089 (126)	2971 (115)	3210 (134)
Woodslee	3058 (139)	3259 (130)	3090 (134)	3100 (131)	3094 (132)
Ridgetown	3121 (148)	3200 (127)	3162 (136)	3166 (135)	3200 (141)
St. Thomas	2981 (151)	3050 (131)	3167 (141)	3052 (140)	3171 (152)

$$*Heat Units = \left[(T_{min} - 40) + (4.39 T_{max} - .0256 T_{max}^2 - 155.18) \right] / 2$$

	<u>Mean</u>	<u>"s"</u>	<u>C.V.</u>
HEAT UNITS:	3109	82	2.6%
DAYS:	135	9.7	7.2%

AFTERNOON SESSION, February 19

Blackbird Depredation Research in Relation to Field Corn Production
(Abstract)

John T. Linehan

A. Bureau Responsibilities and Research Objectives

The Bureau of Sport Fisheries and Wildlife, in implementing the migratory bird treaty between the U. S., Canada and Mexico, assumes certain responsibilities for developing ways of reducing crop losses caused by migratory birds. All possible aspects of the bird depredation problem are being investigated; much of the initial effort has necessarily gone toward research methods, tools, and techniques. Major research emphasis is toward means of reducing numbers; however, substantial developments in the field of crop damage avoidance would cause a shift in emphasis. The Bureau also advises and coordinates the research of other interested agencies. We worked on the formation of an Agriculture Experiment Stations Regional Research Project (NE-49).

B. Bird Depredation Research (General)

Fifty or more institutions and agencies in the United States and elsewhere are working not only on crop damage but on problems concerned with birds as health hazards and aircraft hazards, and on problems involving nuisance birds. Many limited areas such as damage to utility poles, to direct planted forest seed, to holly, etc., also received attention.

Besides crop protection research, the following work is carried on:

1. Population studies (numbers - through roost surveys; movements - through banding; production - through nest surveys).
2. Behavior and physiology studies (social behavior; sounds and communication; response to control measures; sensory organs; breeding habits).
3. Reproduction inhibition (male sterilization; control of sex in progeny; egg production, hatchability and fertility).
4. Toxicology (acceptance and baiting; hazard to humans and non-target species; screening oral and contact poisons).

5. Trapping (two traps invented by the author provide birds for research and constitute a tool for potentially reducing populations locally: a. floodlight trap - a large funnel-shaped net placed opposite a roost. Birds when disturbed fly toward lights at base of trap and are caught. Catches as high as 100,000 birds have been made. b. decoy trap - a large net-covered enclosure with captive birds inside to attract others. An estimated 1/4 million blackbirds and starlings have been caught in fewer than 100 traps).

C. Crop Protection Methods

1. Repellent studies: A method has been developed for testing seed protectants so that bird attack is isolated from influence of the treatment.
2. Scare device evaluations: We found it more effective to compare devices in the same field at different times than at different fields at the same time. We have compared broadcast alarm cry to several types of automatic exploders.
3. Other protection: We have only casually evaluated the use of twirlers, streamers, flashers, firearms, electric shockers, netting, tanglefoot, high frequency sound, models of predators.

D. Damage Assessment Considerations (field corn)

1. Uniform ways of measuring and expressing loss are essential for studies and surveys.
2. Units of measure vary with the crop, its use, and objectives of study.
3. Loss is primary (kernels attacked), secondary (mold & insects that follow), or indirect (cost of protection, downgrading the crop).
4. We are in the seventh year of a damage assessment study designed to reflect the relation of corn damage to proximity of marshland and to distance from a river, and to demonstrate variation in damage associated with location and with year. Optimum sample size and proper sample selection within a field are being calculated. Maturity date, varietal resistance and protective measures -- factors influencing extent of damage, are being noted in the study.

5. Damage criteria have been evaluated by measuring damage on over 1000 ears in four different ways: inches of ear attacked, weight loss of grain, number of kernels pecked, percent of kernels pecked. For general surveys, ears are assigned to one of five classes depending on percent of kernels destroyed; from these, the actual amount of corn destroyed is computed.

E. Varietal Testing

1. The aim is to realistically rate hybrids for resistance.
2. Three methods of testing have been developed: open-field tests (normal conditions, but no control over bird pressure and only limited control over date of maturity), enclosure tests (bird pressure controlled), rack tests (pressure and maturity both controlled).
3. Actual rating of varieties will need to be done by other agencies. Our help and cooperation is offered.
4. ^{we} Have collected limited information on 75 field corn varieties. The three most resistant happen to be long-season types.

A "corn stunt" meeting was held at State College, Mississippi in 1963 and a second corn virus meeting at Wooster, Ohio in November 1964. G. F. Sprague reported on these two meetings and a brief resumé is included as a part of this report.

Corn stunt virus was first reported from the southeastern states in 1962 and confirmed by transmission tests with the established vector Dalbulus maidis. Since 1962 positive transmission tests have been obtained from Louisiana and Florida as well as Mississippi. Based on symptoms alone the disease may be widespread throughout the southeast. Dalbulus maidis is not native to this area so there is a strong supposition that one of the other leafhoppers may serve as the normal vector. Plantings to determine resistance and susceptibility were made in Mississippi and Louisiana in 1964. Several of the local inbreds and hybrids exhibited some degree of resistance or tolerance.

In 1962 a corn virus disease, later designated as maize dwarf mosaic, was observed in the Ohio valley. Considerable spread was observed in 1963 and in 1964 this disease was reported from Virginia, Ohio, Kentucky, Indiana, Illinois, Missouri, Iowa, Arkansas and Kansas. This virus produces symptoms which, in the field, are indistinguishable from corn stunt. It differs from stunt, however, in that it can be transmitted mechanically. Several species of aphids can transmit the disease. Active research on this point is still underway. Positive transmission by aphids has been reported from Virginia, Ohio, Indiana, Arkansas and Missouri. This virus will attack Johnsongrass, the sorghums and many of the grassy weeds commonly found in corn fields. Tests to establish host range are in progress at several institutions.

Plantings were made near Portsmouth, Ohio to determine resistance or susceptibility of locally important inbred lines and hybrids. A few lines were identified as possessing some resistance or tolerance. The incidence of such resistance was much lower, however, than that found to "stunt" in the Mississippi plantings. Mexican material known to possess resistance to stunt appeared to be resistant in both the Mississippi and Ohio plantings.

Following this presentation there was considerable discussion on the need for cooperative tests on resistance to maize dwarf mosaic in the Northeast. It developed that many of the lines commonly used in this area are now being tested at either Ohio or Indiana. Reports from such tests will be made available to members of this conference prior to corn planting. The possibility of including additional lines in the 1965 field plantings in Ohio will be explored.

Following this discussion the conference adjourned at 4:30 p. m. to permit work planning session of the various committees.

MORNING SESSION, February 20

The meeting was called to order at 8:30 a. m. The first order of business was to receive the committee proposals for 1965.

Committee Proposals for the 100-300 Maturity Group

1. Six hybrids selected on the basis of their 1964 performance in Ottawa and Macdonald College tests will be grown in Pennsylvania, New York, Quebec and Ontario. The hybrids in question are:

(Col09 x A509) (Q163 x Pa32)
(Col09 x A492) (Co 25 x A509)
(Col25 x Col09) (Col58 x A509)
(Col50 x Col09) (Col25 x Q163)
(Col25 x A509) (Col09 x Q163)
(Col09 x A495) (Col58 x A509)

All of these are considered to fall in the 100 maturity series. Seed will be distributed from Ottawa.

2. From some 55 double crosses tested at Penn State in 1964 it is expected that when the data are analysed the need for further testing of about 20 of these will be indicated. Since these fall in the 300 maturity series, testing will be limited to Pennsylvania and New York. ~~CCE~~ will plant one replication for observation at a yet undetermined location. Seed will be distributed from Penn State.

L. S. Donovan, Chairman
R. I. Brawn
W. I. Craig
H. L. Everett
C. E. Manchester

Committee Proposals for the 400-600 Maturity Series

The double-cross hybrids made in 1964 on the basis of predictions from 1963 data will be grown at all locations expressing an interest. To date, Pennsylvania, New York, Cooperative Corn Research Project and Massachusetts have requested seed. Entries to be included are as follows:

<u>Entry</u>	<u>Entry</u>
(C153 x NY511)(NY821 x Pa41)	(NY821 x Pa37)(Pa41 x NY511)
(W144 x Pa41)(NY821 x NY511)	(NY821 x Pa405)(C153 x NY511)
(W144 x NY821)(C153 x Pa41)	(NY821 x Pa405)(Pa41 x NY511)
(W144 x NY821)(Pa41 x NY511)	(NY821 x Pa405)(IoB8 x W64A)
(NY821 x NY511)(Pa405 x W64A)	(NY821 x Pa405)(C153 x NY511)
(NY821 x NY511)(IoB8 x W64A)	(IoB8 x NY821)(C153 x NY511)
(NY821 x W64A)(IoB8 x A401)	(IoB8 x NY821)(Pa41 x NY511)
(NY821 x NY511)(IoB8 x Pa405)	Cornell M3
(NY821 x ES191-71)(Pa41 x NY511)	Pa290
(NY821 x ES191-71)(C153 x NY511)	Pa 444

Top-crosses of new inbreds to the single cross (Pa11 x Pa54), and to the double cross, Michigan State 250 (Oh51 x R53) (MS W10 x MS 206), will be grown in yield trials in 1965. New York, Pennsylvania, Massachusetts and Cooperative Corn Research Project have requested seed.

H. L. Everett, Chairman
C. E. Manchester
J. H. McGahen
M. L. Risius
H. Yegian

Committee Proposals for the 700-900 Maturity Series

Four member institutions will test 64 three-way crosses made up by CCRP, Pa., and N. J., Maryland will also test. The test design will be an 8 x 8 partially balanced triple lattice, the plans and the summarization to be furnished by Pennsylvania. The tester single crosses are C103 x B14, C103 x Pa887P, and B37 x Oh43.

J. C. Anderson, Chairman
J. Buchert
M. W. Johnson
R. G. Rothgeb

Committee Proposal on Diseases and Pests

There will be no cooperative studies for 1965. However, it was agreed that C. C. Wernham be encouraged to make up the proposed synthetics using maize dwarf mosaic resistant lines. He had suggested making an early, intermediate, and late group to use to top cross to susceptible singles to produce stop-gap hybrids until a recovered line backcrossing program could be completed.

A list of all Northeast material tested for maize dwarf mosaic will be compiled so as to prevent duplication of screening by stations.

Committee Proposals on Corn Silage Research

Research planned for 1965 includes the following general categories:

1. Variety trials for green weight, moisture percentage, and dry matter.
2. Quality evaluation through animal digestion trials.
3. Quality evaluation through laboratory tests.
4. Applied research by on-the-farm and extension evaluation.
5. Trials involving hybrids with a range in maturity involving other variables, as: population, date of planting, date of harvest, grain vs. silage yields.
6. Selection for silage potential in diverse germ plasm.

Ten of the cooperation agencies who had representatives at the conference intend to be active in one or more categories. The committee recommends that consideration be given to conducting either separate trials for silage evaluation of top cross and/or single and double cross tests conducted jointly by conference members or harvesting one or more replicates of such trials for silage.

The following hybrids should be entered in appropriate tests to serve as check entries until such time as uniform trials and data collection procedures can be worked out:

Early hybrids - NE 144, Pa. 290, Cornell M-3
Medium hybrids - Cornell M-3, Pa. 602A
Late hybrids - Pa. 602A, N.J. 9, N.E. 912
Male sterile hybrids - Pa. 290, Pa. 602A

The Chairman then called for the report of the Committee on Registration of NE Hybrids. Dr. Rothgeb informed the Conference that a request had been received from Pennsylvania for the assignment of a NE number to the double-cross hybrid (WF9 x Oh51A)(B14 x C103). Pennsylvania is interested in this hybrid and it has been the Conference policy to not assign a State designation to a new combination unless one of the component lines had been developed by the interested State. This hybrid has been tested for 4 years in Pennsylvania, 2 years in Maryland and one year in New Jersey. The hybrid having met all performance requirements Dr. Rothgeb moved "That the hybrid (WF9 x Oh51A)(B14 x C103) be assigned the number NE 780, pending a determination of whether the hybrid was in commercial production under some other State or Regional designation."

The MOTION was seconded and passed.

The Conference then turned to a discussion of corn populations in terms of response, row spacings, methods of testing and equipment for harvesting.

There was no agreement on optimum population densities for either grain or silage production. States in the southern part of this region preferred populations below 20,000. Under New York conditions considerably higher populations were preferred to either silage or grain.

Data were cited from several experiments but the only summary was received from Pennsylvania. Their report is given below.

Hybrid Yield Trials at Different Plant Populations

Since 1959, Commercial Hybrid Tests and some experimental tests in Pennsylvania have been planted at two populations, approximately 13,000 plants per acre and 17,000 plants per acre, at 3 locations. Number of hybrids per test ranged from 36 to 81. 1959 and 1960 tests were hand planted and hand harvested. Later tests were machine planted and picked with a picker-sheller. Row widths were most often 40" but it varied from 36" to 42" among locations.

1959, 1960 and 1961 were good years at most locations while 1962, 1963, and 1964 were dry years at most locations.

Yields, percent broken stalks and number of locations where hybrid x population interactions were significant are given in the following table:

	Bu/Acre Population		Sig. H x P	% Broken Stalks Population		Sig. H x P
	High	Low		High	Low	
1959	104	98	2 of 7	3	2	4 of 7
1960	127	111	5 of 9	12	9	3 of 9
1961	99	90	2 of 8	29	22	3 of 7
1962	67	57	None	9	5	2 of 9
1963	70	66	None	2	1	1 of 9
1964	76	73	1 of 8	22	21	1 of 8

In 12 of 48 comparisons, yields from the lower plant population were equal to or better than the higher plant population. Of a total of 28 comparisons where yields were over 90 bushels per acre, only 3 had higher yields at the low plant population level. Of a total of 11 comparisons where yields were below 60 bushels per acre, six had higher yields at the low plant population level.

With the exception of 1964, high plant populations almost always had the greater percent of broken stalks. This anomaly may have resulted from a high degree of barren stalks. Cursory counts of the two populations at one location in mid-September indicated almost 8% barren plants in the high population as opposed to about 2% in the low population.

Even with dry weather in 3 of 4 years and a greater percentage of broken stalks in the high population, picker-sheller yields from the higher plant population resulted in an average increase in yield of 6 bushels per acre.

Relatively little information was gained on hybrid response to plant population pressure in the dry years. However, tests at more than one population in good years has some merit in evaluating individual hybrid response to varying plant population.

W. F. Craig
J. H. McGahen
M. W. Johnson
W. I. Thomas

The Conference Chairman then called for the Report of the Nominating Committee.

D. L. Matthews, Chairman of the Nominating Committee presented the following report. "Following careful deliberation, we are pleased to nominate John C. Anderson for the position of Vice-Chairman for the coming year." He MOVED the acceptance of this report which was seconded. There being no nominations from the floor the Secretary was instructed to cast a single ballot for Dr. Anderson.

Under new business D. L. Matthews MOVED "That the Chairman appoint a three man committee to contact the officers and selected members of the NE Climatology Technical Committee to determine the merits of a joint meeting of Northeast Climatologists and Corn Researchers; and to authorize this committee to arrange for such a joint meeting if, in their opinion, it would prove fruitful."

The motion was seconded and passed.

Chairman Brawn then thanked Drs. Brown and Linehan for their contributions to the conference, and the members of the conference for their cooperation. The meeting was then turned over to the new chairman, Dr. R. G. Rothgeb. Chairman Rothgeb thanked Dr. Brawn for arranging for facilities and the excellent meeting. The question was then raised as to the location and time for the next conference meeting. After some discussion D. L. Matthews MOVED "That the Chairman be allowed the discretion of arranging the next meeting the week-end of February 18-19 or February 25-26, 1966 with an expressed preference for the first date if feasible."

This motion was seconded and passed.

The Conference adjourned at 11:45 a. m.

OFFICERS AND COMMITTEE MEMBERS, 1965-66

Administrative Advisor

W. K. Kennedy, substituting for

H. R. Fortman

Executive Committee

R. G. Rothgeb

J. C. Anderson

R. I. Brawn

Committee on Registration of NE Hybrids

R. G. Rothgeb, Chairman

J. C. Anderson

H. L. Everett

W. I. Thomas

Committee on Uniform Tests of 100-300 Maturity Series

L. S. Donovan, Chairman

R. I. Brawn

W. F. Craig

H. L. Everett

C. E. Manchester

Committee on Uniform Tests of 400-600 Maturity Series

H. L. Everett, Chairman

C. E. Manchester

J. H. McGahen

H. M. Yegian

Committee on Uniform Tests of 700-900 Maturity Series

J. C. Anderson, Chairman

J. Buchert

M. W. Johnson

R. G. Rothgeb

Committee on Diseases and Pests

M. W. Johnson, Chairman

J. C. Anderson

C. W. Boothroyd

P. Halinsky

R. G. Rothgeb

C. C. Wernham

Committee on Inbred Release Policy

W. I. Thomas, Chairman
J. C. Anderson
H. L. Everett
D. L. Matthews

Committee on Corn Silage

R. E. Anderson, Chairman
J. C. Anderson
W. F. Craig
L. S. Donovan
M. W. Johnson
C. E. Manchester
R. G. Rothgeb
H. M. Yegian

Committee on Climatology

M. W. Johnson, Chairman
J. C. Anderson
N. Rutger

ROSTER OF ATTENDANCE

Canada

Brawn, R. I.	MacDonald College	P. Montreal
Brown, D. M.	Ontario Res. Founda.	Toronto
Donovan, L. S.	Experimental Farm	Ottawa

Delaware

Cole, R. H.	Univ. of Delaware	Newark
Linehan, J. T.	Bureau of Sport Fisheries and Wildlife	Newark

Maryland

Rothgeb, R. G.	Univ. of Maryland	College Park
Sprague, G. F.	ARS, U.S. Dept. Agr.	Beltsville

Massachusetts

Manchester, C. E.	CCRF-Agway Inc.	W. Springfield
Matthews, D. L.	"	"
Yegian, H. M.	Univ. of Massachusetts	Amherst

New Jersey

J. C. Anderson	Rutgers University	New Brunswick
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New York

Anderson, R. E.	Cornell University	Ithaca
Boothroyd, C. W.	"	"
Kennedy, W. K.	"	"
Koocheki, H. K.	"	"
Risius, M.	"	"
Rutger, N.	"	"
Sonderhausen, E.	"	"

Pennsylvania

Buchert, J. G.	CCRF Laboratory	Palmyra
Craig, W. F.	Penn State University	Univ. Park
Johnson, M. W.	"	"
McGahan, J. H.	"	"

